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Original Article

Analysis of the relationship between power, anaerobic capacity and speed displacement in men between 50 and 60 years of age.

Jhon Fredy Ramírez Villada,[1,2] Carlos Enrique Melo, Robert Giorgi Laverde[1]

1Facultad de Cultura Física, Deporte y Recreación, Universidad Santo Tomás, Bogotá (Colombia).

2Correspondencia: Jhon Fredy Ramírez. Email: jhonramirez@usantotomas.edu.co /jhonramirezvillada@gmail.com

The neural, structural and functional changes happened with the process of aging have led to suggest new intervention schemes with application of aerobic and anaerobic loads. These proposals must be examined carefully because it may cause damage, by characteristics of the degenerative process in accelerating functional dependence. We evaluated 13 athletes, aged 50-60 and attached to athletics groups aimed to analyze the impact of charges on body composition, aerobic, anaerobic capacity and power, and about the speed of travel. Anthropometric evaluation allowed us to estimate the body compartments and Wingate tests and speed on different sections, helped evaluate the transference of force generated functionality. The results reveal that the characteristics of anaerobic capacity and power are influenced by the weight of the different compartments and the cross-sectional area of the thigh. Similarly, the installment of 30 and 45 meters have a direct and positive proportional to the average power generated, but not with the peak of power. In conclusion, the relationship of anthropometric variables, capacity and anaerobic power (Wingate) and travel speed, allow the analysis of structural and functional behavior of the greatest assets, related to the training regimen.

Introduction

The speed has been considered to be in general terms the aptitude to cover a space or to realize a simple movement in the minor possible time (1-3). This capacity can be shown in the time of reaction, the rapidity of execution (expression speed) or the speed of displacement generated, aspects that will be determined by neural factors (quantity and quality of the units motorboats) and structural (type of muscular fibers) (4-6).

On the other hand, consider that the manifestations of maximal strength and maximal dynamic strength are crucial for the manifestation of explosive strength, joint capabilities that have a high correlation with the times achieved in 60 meters or velocities in different sections (2, 7, 8). These evidences are supported on the basis that phasic motor units are larger and are composed of fast fibers (fast fibers twich, FT) that rely on anaerobic metabolism and to develop high voltages with a shorter contraction time (8, 9).

With regard to the above, it is important to note that there are new models of intervention with subjects older than 50 who have shown promising results regarding the ability to express different types of force, alter the muscle cross-sectional area (hypertrophy) and increase the level of functional independence (10- 12). However, these models are not intended to stop the natural aging process, but are shown as alternative methods to slow the degenerative changes occurring in these stages of life.

If, as the authors raise, the strength can be changed in subjects who started or are in the middle stage of aging (age >50) is appropriate to address the transfer of adaptations to common tasks such as walking, running, jumping (13-15), etc. The problem is that most test related to this issue have been validated in young people active, but not in subjects over 50 years, where it became more evident deterioration in the agency as a result of the aging process.

This scenario leads us to consider the importance of analyzing the reciprocal of the capacity and power of different energy production systems required under aerobic and anaerobic conditions, to understand more precisely the effects of the intervention models applied to functional independence and to suggest new control strategies that can be easily implemented.

The first stage of this research aims to analyze the relationship of smooth scrolling speed in different sections, power and anaerobic capacity in men between 50 and 60 years old with history of aerobic training.

Materials and methods

Sample

We interviewed 40 men belonging to the groups Masters athletics in the city of Bogota (Colombia), with a physical practice of not less than one year, a training frequency of 4-7 days per week and facing charges of aerobic training, which 17 individuals met the inclusion criteria (Table 1).

Accepted after external review to start the process of selection and organization of the tests, subjects were assessed clinically using the following aspects:
alteration of the spine, upper or lower limb, amputations, sequelae of fractures, prosthesis, treatment with steroids, cardiovascular disease and joint conditions.

For participation in the process, the sample provides the informed consent form detailing the objectives, procedures and risks of research and the use of confidential data. This study was approved by the health team

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Chart number 1. Selected sample characteristics

Variables	$\bar{x}$	Standard deviation
Age	54.8	3.81
Height	1.7	0.06
Weight	72.2	8.71
Body Mass Index (BMI)	24.9	2.24
Body fat mass (Brozek)	22.9	6.43
Lean body mass (Brozek)	18.8	7.95
Muscular surface area- thigh	54.9	3.45

and ethics of the Universidad Santo Tomás (Bogotá) and was conducted in accordance with the parameters set in the declaration of Helsinki.

Of the 17 men who completed the selection criteria, 13 completed the study, there was a loss of 23.5% sample, individuals who were excluded by their irregular attendance, neglect or failure to attend any part of planned controls for the study. No injuries were referred, except subjective muscle pain and fatigue after the test execution.

Experimental Design

The protocol of this study is shown in fig.1, which warns that the tests were confirmed between 2 and 3 times in two weeks, separated by an interval between the tests of 2 days, intended to reduce possible learning effect and get some data analysis.

Assessment tests

The body composition assessment was made following signs of Kinanthropometry Spanish group (16, 17). We determined the percentage fat, percentage lean, bone and the residual percentage by measuring skinfold, biceps, triceps, subscapular and supracristal, following the equations of Brozek et al, De Rose and Guimaraes, Rocha, 1975 Wurch, 1974, respectively and with reference to Durning and Womersley (1974) to estimate body density. Similarly, we calculated the body mass index and corrected thigh circumference in addition to the study (16-20).

The instruments used for anthropometry consisted of: skinfold caliper Slimguide ®, anthropometric tape measure and caliper Holtain ® EBRD ®. To the knowledge of neuromuscular function, subjects were familiar with the different actions (speed 15 meters flat, smooth speed 30 meters, 45 meters and smooth speed Wingate test) 7 days before the first control.

For the assessment of anaerobic power capacity and was selected the Wingate test (21), using a bicycle Monark model 810, which apply the pedal to the lower limbs for 30 seconds, against a constant resistance (0,075 kilograms per kilogram of body weight) in response to international considerations. Before to beginning of evaluation, there fitted the height of the chair and the thongs as the length of the low members of the patient, a verbal sign (beginning) happened, a regressive count (3, 2, 1) and one continues verbal motivation that should to assure the maximum declaration of the physical capacity.

As for the speed of displacement, the distances to analyze were stretches of 15, 30 and 45 flat meters (22-24), which were established making use of a tape measure, a drawing of the line of trajectory on the surface (to delimit the space to cover) and a drawing of the line of preparation to two meters before the station of exit (fig. 2.). The times were coming out and turning on the right side, seeking thereby to control the quality of the measurement points were established and visible to the test helped to determine the route. Executed in each test were scored 3 tries and the most representative for further analysis, being used as instruments for SMEs: Konus® digital timers, pins and a tape measure 30 m long Holtain®.

Statistical Analysis

To calculate means and standard deviations were used standard statistical methods in the case of the estimate of the correlation were applied nonparametric tests (Sperman and Kendall), establishing levels of significance with $p < 0.05$ and highly significant for $p < 0.001$.

Figure 1. Arrangement and sequence of the tests

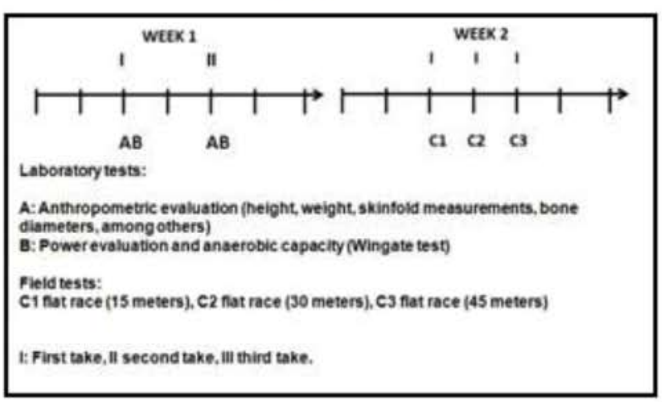
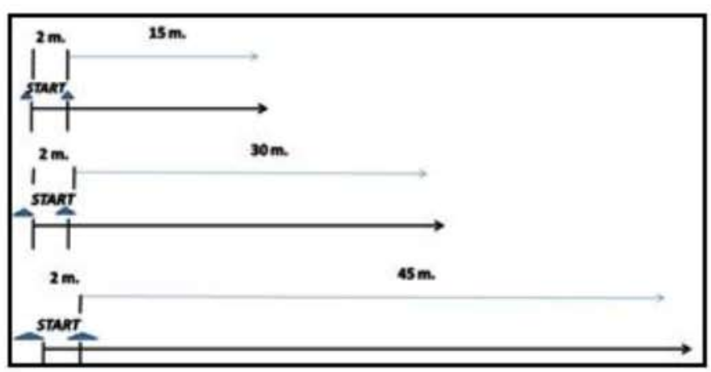


Figure 2. Track lengths used to evaluate the displacement speed



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Results

The correlations between anthropometric variables, the Wingate test and the speed reached in the proposed distances of 15, 30 and 45 meters are presented in Table 2. Outstanding relationships between distances of 30 meters-45meters and the average power generated, with values close and highly significant. Emphasizes the same way, no correlation between lean mass and corrected thigh circumference, and a half peak power generated with the maximum speed reached.

They can also be assessed proportional and positive behavior of the variables, where the gradual increase in the overall average power and power per kilogram weight is observed greater speed for the task of 30 meters.

Similar observations stand out from the overall average power or average power per kilogram of total mobilized to the maximum speed reached in the task of the 45 meter flat.

Chart 2. Correlation of the variables analyzed

Variable 1	Variable 2	Significance level
Weight	Peak power	r = 0.801 p= 0.001
BMI	Peak power	r = 0.736 p= 0.004
Corrected thigh perimeter	Peak power	r = 0.559 p= 0.031
Corrected thigh perimeter	Peak power/Kg	r = 0.225 p= 0.459
Corrected thigh perimeter	Average power	r = 0.489 p= 0.090
Corrected thigh perimeter	Peak power/Kg	r = 0.209 p= 0.484
Corrected thigh perimeter	Speed 15 m	r = 0.474 p= 0.101
Corrected thigh perimeter	Speed 30 m	r = 0.328 p= 0.273
Corrected thigh perimeter	Speed 45 m	r = 0.262 p= 0.388
Lean body percentage (Brozeck)	Peak power	r = 0.456 p= 0.117
Lean body percentage (Brozeck)	Peak power/ Kg	r = 0.352 p= 0.239
Lean body percentage (Brozeck)	Average power	r = 0.154 p= 0.616
Lean body percentage (Brozeck)	Average power/ Kg	r = 0.170 p= 0.578
Lean body percentage (Brozeck)	Speed 15m	r = 0.326 p= 0.278
Lean body percentage (Brozeck)	Speed 30m	r = 0.044 p= 0.886
Lean body percentage (Brozeck)	Speed 45m	r = 0.118 p= 0.700
Speed 15m	Peak power	r = 0.135 p= 0.660
Speed 15m	Peak power/ Kg	r = 0.284 p= 0.347
Speed 15m	Average power	r = 0.019 p= 0.950
Speed 15m	Average power/ Kg	r =0.450 p=0.123
Speed 30m	Peak power	r = 0.030 p= 0.922
Speed 30m	Peak power/ Kg	r = 0.033 p= 0.915
Speed 30m	Average power	r = 0.618 p= 0.024
Speed 30m	Average power/ Kg	r = 0.397 p= 0.179
Speed 45m	Peak power	r = 0.209 p= 0.492
Speed 45m	Peak power/ Kg	r = 0.256 p=0.398
Speed 45m	Average power/ Kg	r = 0.427 p= 0.146
Speed 45m	Average power	r = 0.661 p= 0.014

Discussion

Considering the physical concept of power, which determines the value of it by the product of the applied force and distance (25), is a clear and highly significant proportional relationship found between total body weight and peak power this work ($r = 0.80$, $p = 0.001$). However, one should consider that the total body weight (lean, fat, bone and residual) influences the force exerted at some point in the descent phase in pedaling, goes into action as a determinant value, as is the force of gravity.

What is expressed is to argue that the force exerted by the lower limbs is influenced by the load in kilograms of fat component, since it must be defeated with the same amount of lean lower body involved in the total power generated. These data have been utilized in several studies and in the same application of the Wingate test, where it becomes necessary to estimate lean mass mobilized in order to clarify the extent of participation of it in the requested task (21, 26).

In this connection it is interesting the correlation observed between total body weight, BMI, thigh circumference and corrected peak power recorded in the subjects assessed, which although not before 5 seconds, if it is linear showing that the characteristics power of the subjects were altered by the percentage of lean mass requested, and as indicated by several studies, the quality and quantity of the fibers involved (ST / FT) (27-30).

The results are consistent with studies which demonstrate the strong relationship between the state of the musculoskeletal system with the anaerobic condition, and hence the degree of operational independence, which must consider the quality and quantity of lean behavior increases suffering among the 25 peaks -30 years, when he reported a gradual deterioration that is noticeable after 50 years of age and that affects the work under anaerobic conditions (31- 34).

Since the objective was to establish a distance that allows to analyze and diagnose the state of healthy subjects aged 50-60 and graphically reflecting the influence of the training methods applied, we proceed to discuss the results related to this aspect.

By comparing the peak power and average power with the speed achieved on the 15 meter flat, there are no significant values. Moreover, when comparing the half-peak power, manifested in speed over the stretch of 30 to 45 meters, called attention to the relationship between average power and speed achieved for each task, which suggests a low-side characteristics power in the subjects rated (established by the time to reach the peak of power), and the other a high capacity linear subjects and to maintain efforts in time without the presence of fatigue (average power).

The proposed analysis allows relating the proportion of fast fibers (fast twitch, FT) versus slow fibers (Slow Twitch, ST) taking into account the time required to reach peak power. The data to reflect on the deterioration of the capacity and power of applied energy systems, which can be explained in part by neural and structural deterioration mentioned by several authors, but which also shows the type of physiological adaptation to stimuli to which the subject is subjected (31-33).

We remind to the reader that the sample values are greater than 50 years with high participation in aerobic activities, models of intervention that while collaborating on improving cardiovascular endurance, harm when used in excess and in these specific age, the expression of strength and power, and consequently the manifestation of speed, key elements for maintaining functional independence (34, 10).

Already some authors (8, 35, 36) were explained as the tonic motor unit, consisting of slow twitch (ST) is characterized by high resilience, while the phasic motor unit, consisting of fast-twitch fibers (FT), require anaerobic metabolism to eventually develop high stresses.

The intent of the investigation was focused on to suggest an estimate of field test, to consider the relationship expressed strength, speed metabolism manifested requested and, where data on sections of 30 meters and 45 meters show capacity of over 50 trained with stimuli aerobics, to keep the speed of the task steadily, but not definitive, as it becomes necessary to apply an intervention model aimed at the force, allowing state with clarity and certainty the ideal stretch to use, and the limit of the neural adaptations, structural and metabolic attainable at these ages.

We conclude therefore that the capacity and power characteristics are influenced by the weight in kilograms of lean component, fat and thigh circumference corrected in the study group, where you should specifically consider the percentage of participation among slow fibers (ST) and fast twitch fibers (FT). Similarly, the stretch of 15 meters is not related to peak power, average power and the minimum, however, on the stretch of 30 to 45 meters correlations of the average power and speed, suggests that subjects can maintain the intensity of the task consistently.

The results suggest inviting new models of intervention, changing the traditional models geared solely to training of aerobic capacity for mixed models (force / resistance) (10, 37, 38). This work will increase the number of diagnostic tests for control of anaerobic capacity and power as well as for the analysis of the sedentary subjects or healthy in training loads operated with aerobic and anaerobic conditions.

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